CHOOSING NDT FOR AN AGING AIRCRAFT PROGRAM

National Aerospace
NDT Board of Australia Inc.
ABN 37 760 071 804
Please, don’t infer any of this presentation to be an endorsement or recommendation for any particular NDT method or technique.
There is no magic bullet!
CASA has accepted that about 5,400 aircraft are of concern and 3,300 are of potential concern for aging aircraft issues. *ACTS*

*That’s a lot of aircraft!*
Aircraft Aging Processes

Corrosion
Aircraft Aging Processes

Fatigue
Aircraft Aging Processes

Wear
Also Damage and Deterioration
Expectations of a type of total inspection solution like a CT scan...
Might look like this….but it is not available.
It takes the resources of a large government to acquire sophisticated NDT inspection systems.
The **objective** is to apply any NDT method which is both technically effective and cost effective.

To be **technically effective** the threshold size of a significant defect must be reliably detected.

To be **cost effective** it must be cheaper than aircraft teardown or part replacement.
Methods of NDT

- Visual
- Liquid Penetrant
- Magnetic Particle
- Eddy Current
- Ultrasonic
- X-ray
- Microwave
- Acoustic Emission
- D-Sight
- Vibration Analysis
- MOI
- Magnetic Measurements
- ACFM
- Thermography
- Replication
- Laser Interferometry
- Eddy Current
- Flux Leakage
- Tap Testing
- Acoustic Emission
Visual Inspection
Low Cost Borescope
Moderate to High Cost
D-Sight
surface deformation imaging
What other NDT will detect corrosion?

**Ultrasonic** – limited to the solid material contacted by the probe
- will be largely ineffective on pitting corrosion
- will be affected by unfavourable geometry of the part
- thin sections can be difficult to resolve

**Radiography** – Hazardous activity
- about 10% thickness loss is the minimum detectable
- sensitivity is reduced in multi-layer structures
- sensitivity reduced where corrosion products are trapped
- assessment is made on a limited number of images
What other NDT will detect corrosion?

**Eddy Current** – Sensitivity reduces rapidly with increasing depth
- Corrosion eddy current signal interpretation is often difficult
- Subsurface structure/configuration must be known
- Not generally effective for ferrous materials
- Magneto-optic imaging (MOI) has promise
- Individual calibration standards are required

**Dye Penetrant** – aid to visual inspection and the defect must be open to the surface - may be used to check if surface corrosion has been removed after rework.

**Thermal Imaging** – Limited usefulness unless expensive enhanced systems are used such as Thermal Wave Imaging.
Radiograph of corrosion in an engine mount tube
Don’t expect to get results like this from the type of equipment most often used for thermal imaging.
Eddy current inspection of rotor blades for internal corrosion
What other NDT will detect fatigue induced defects?

**CAUTION: Material may be fatigued …… however it may not yet have developed a detectable defect. General NDT methods will not identify material which is fatigued. Some hardness or conductivity tests may have limited application.**

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<th><strong>Ultrasonic</strong></th>
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<td>Geometry of the structure and defect is critical</td>
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<td>New phased array equipment is good but expensive</td>
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What other NDT will detect fatigue induced defects?

**Eddy Current** – Sensitivity reduces rapidly with increasing depth

- Small surface fatigue cracks may only be detected with access to that surface.
- Small detecting eddy current area - not well suited to large area inspections.
- Can be effective for ferrous materials.
- Material specific calibration standards are required.

**Magnetic Particle** – excellent for small fatigue cracks

- Limited to ferromagnetic materials.

**Dye Penetrant** – aid to visual inspection and the defect must be open to the surface.
Phased Array ultrasonic inspection of scribe line defects

$60k + training + application specific
Ultrasonic inspection of baggage door skin for cracking
Eddy current inspection of fuselage lap joint
Radiograph of fuselage steel doubler cracks
Magnetic particle indication of a fatigue crack
Magneto-optic Imaging (MOI)

Subsurface (0.080”) image of cracking

Surface cracking image

Head-up display

Imaging device

Control panel
Magneto-Optic Image can also show subsurface aircraft skin corrosion
“Area of particular interest”

MOI scan

Radiograph (contrast enhanced)
Thermal Imaging for Wiring

Inspector should be qualified
Wiring must be under electrical load
Inspector must a baseline information
Thermal camera must have line of sight to the wiring
Thermal camera must have adequate resolution and sensitivity
Not particularly suited to detect degraded insulation
What does NDT offer?

Potential to identify and characterise defective conditions in aging aircraft structures without expensive teardown.

However it requires........

Specialist practitioners, preferably with relevant experience.

Equipment and calibration standards suited to the task.

Proven inspection procedures with realistic POD and defect identification.

Inspection procedures which are approved data either by OEM, the Regulator or Engineering Delegate.

Understanding that NDT methods are often complimentary and no one method is a panacea for aging aircraft inspections.
NDT Qualification Levels Described .....
What would a prudent aircraft operator or maintainer do when sourcing NDT?

ASK SOME QUESTIONS ..........
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• Can the NDT technician show valid qualifications in the NDT method to be used, and are these qualifications acceptable to CASA or the NANDTB?

• Technicians working independently should be Level 2.
Can the NDT service provider show that he has a quality system which ensures his equipment is maintained and calibrated?

ASK SOME QUESTIONS .........
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* Does the NDT technician have experience relevant to the work?
* Is the equipment (including calibration standards) and NDT technique to be used as per the approved data, or any deviations approved according to the regulations?
* In the absence of a defined NDT inspection technique, will the NDT service provider be able to work with engineering and a NDT Level 3 person to develop one? Engineering approval is required.
Welcome to the website of the National Aerospace Non Destructive Testing (NDT) Board of Australia

The Board acknowledges the Civil Aviation Safety Authority and the Aerospace Industry for their essential support and assistance, which enables the Board to operate and to bring to you this useful site. It has a range of information to help those involved in NDT in the Australian aerospace industry.

Our Objectives

Helping you understand the requirements of EN 4179, NAS 410 and AS 3669

The Board's objectives are listed in our publications found on the site. The most fundamental of these is to work with CASA to advance and promote aircraft safety, through the correct application of NDT in aircraft maintenance. Integral to this is the oversight and recognition of employer based qualification and examination programs which comply with the EN4179 / NAS 410 and AS 3669 Standards. The Board offers this oversight and an interpretation guideline to help Industry, training organisations and NDT technicians understand how to apply these standards to their industry. The Board is also a reference point for the Aerospace Industry on NDT matters, and its membership's wide experience makes it well placed to do this. The contact us page is a direct line to the Board.

Board News

Board Activities ->
Journal Articles ->
Meeting Minutes ->

Are you an NDT Technician?

Click here for information on understanding the requirements of EN4179, NAS 410 and AS 3669

Level 3 Recognition for EN 4179 / NAS 410

Information on how to apply for Level 3 recognition

www.ndtboard.com
Many thanks for your attention,

and thanks to